

Accuracy Characteristics for ZDC Risk Reduction Scenario Hours 1740-2030

1 Introduction

This document contains scenario characteristics for hours 1740 to 2030 GMT recorded on October 11, 2000 at Washington ARTCC (ZDC). Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, and flight plan adherence. Definitions of the provided scenario characteristics are provided in Reference[1].

2 Reference

[1] Paglione, M., Oaks, R., Ryan, Dr. H., Summerill, J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

3 Center Airspace

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZDC Center using the October 11, 2000 ACES chart cycle. Information provided in Table 1 was gathered from running URET PRE and local knowledge.

Table 1: Center Airspace Characteristics

Metric	Definitions	Count
Airports	From URET DU Adaptation List	TBD
Sectors	From URET DU Adaptation List	TBD
SAA	Special Activities Airspace	TBD
APDIA	Automated Problem Detection Inhibited Area	TBD
SID	Standard Instrument Departure	TBD
STAR	Standard Arrival Route	TBD
PAR	Preferential Arrival Route	TBD
PDR	Preferential Departure Route	TBD
PDAR	Preferential Departure Arrival Route	TBD

4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

Table 2: Count of Current Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	210	90
$5 \leq d < 10$	265	105
$10 \leq d < 15$	407	157
$15 \leq d < 23$	928	357
$23 \leq d < 30$	879	368
Total	2689	1077

Table 3: Count of Trial Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	210	84
$5 \leq d < 10$	265	95
$10 \leq d < 15$	407	136
$15 \leq d < 24$	1081	371
$24 \leq d < 30$	726	277
Total	2689	963

4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

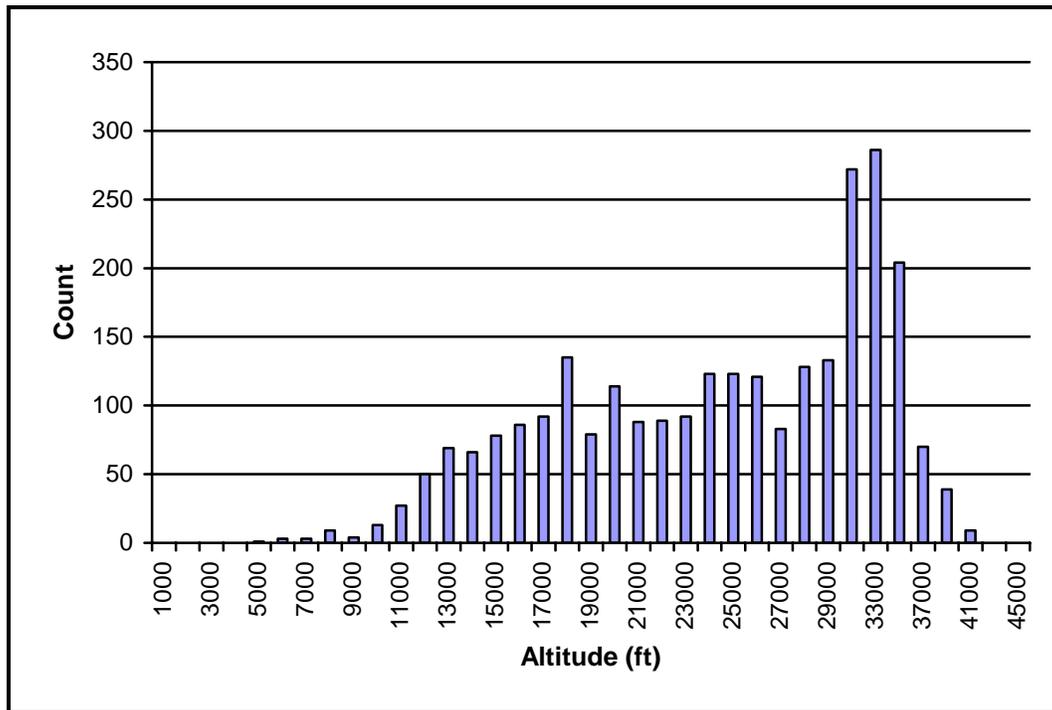


Figure 1: Aircraft to Aircraft Encounters by Altitude

4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 4: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	62	21	9	23	115
Descend-Descend	295	45	21	27	388
Climb-Climb	123	18	6	18	165
Cruise-Climb	360	57	73	199	689
Cruise-Descend	378	134	121	262	895
Climb-Descend	133	49	37	185	404
Unknown	26	2	0	5	33
Total	1377	326	267	719	2689

5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

Table 5: Count of Current Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts ¹	163	94
$d = 0^2$	112	76
$0 < d < 7$	797	547
$7 \leq d < 9$	231	163
$9 \leq d < 11$	242	175
$11 \leq d < 16$	578	408
$16 \leq d < 30$	1905	1313
Total	4028	2776

Table 6: Count of Trial Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts ³	163	91
$d = 0^4$	112	73
$0 < d < 8$	892	584
$8 \leq d < 11$	378	266
$11 \leq d < 13$	244	166
$13 \leq d < 19$	685	452
$19 \leq d < 30$	1554	995
Total	4028	2627

¹ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

² This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

³ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

⁴ This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

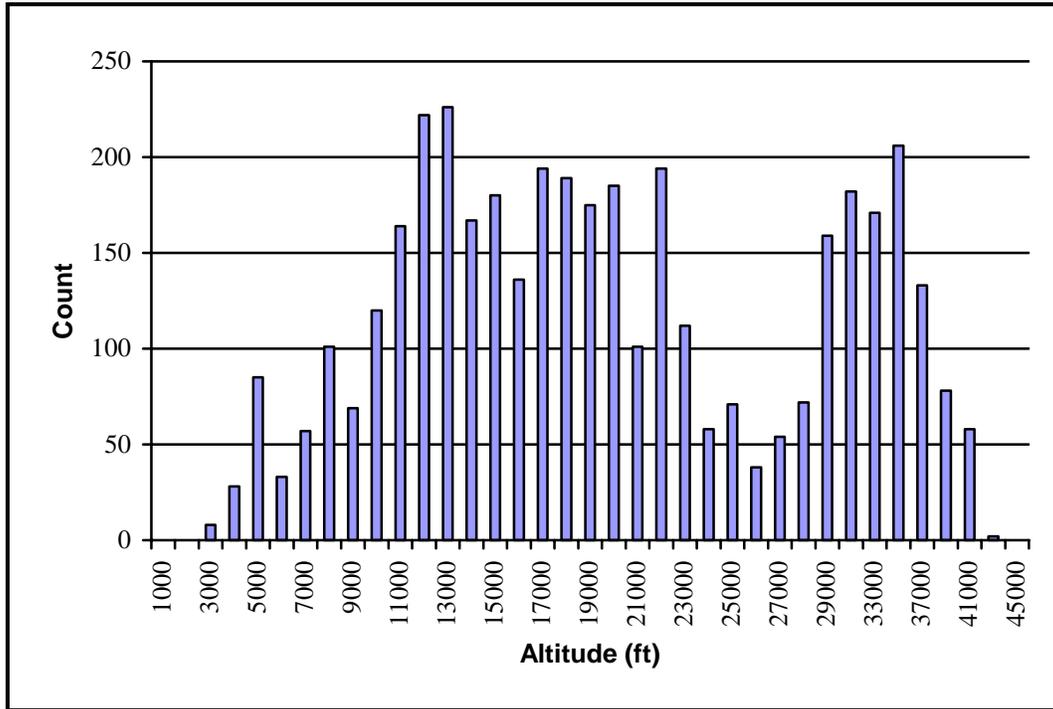


Figure 2: Airspace to Airspace Encounters by Altitude

5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	6	10	4	20
Cruise	29	39	29	97
Descend	15	6	7	28
Total	50	55	40	145

Table 8: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	0	0	0	0
Cruise	0	0	0	0
Descend	5	0	0	5
Total	5	0	0	5

Table 9: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles

Vertical Phase	Count
Climb	8
Cruise	4
Descend	1
Total	13

6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

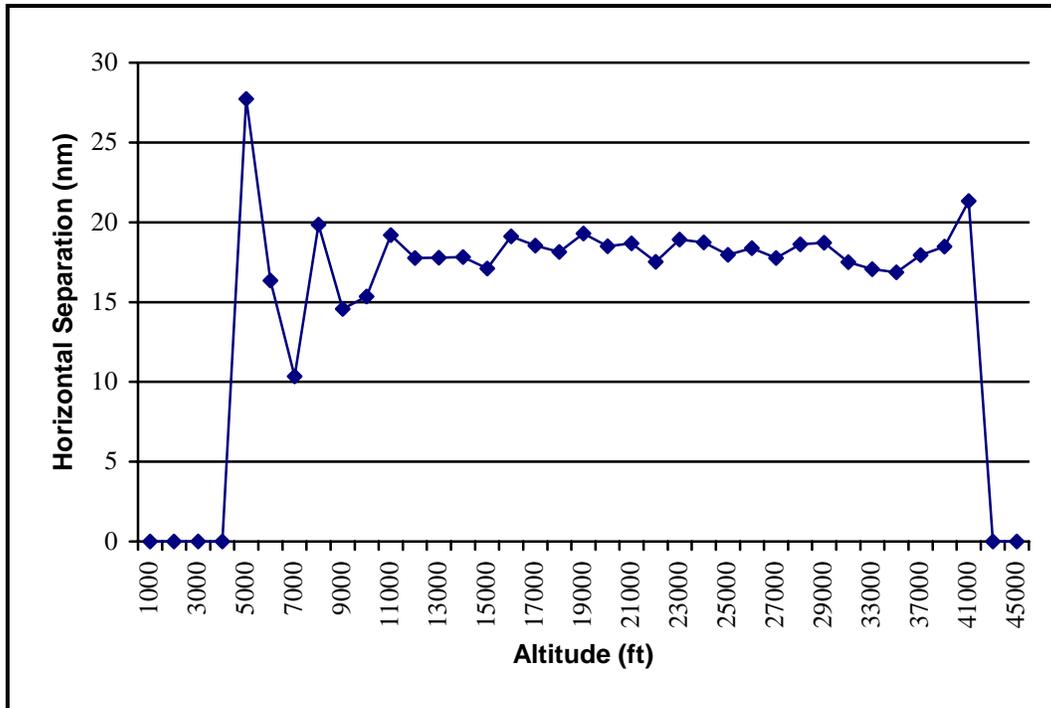


Figure 3: Average Horizontal Separation by Altitude for All Hours

6.2 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

Table 10: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
160.656	172.526	410	0

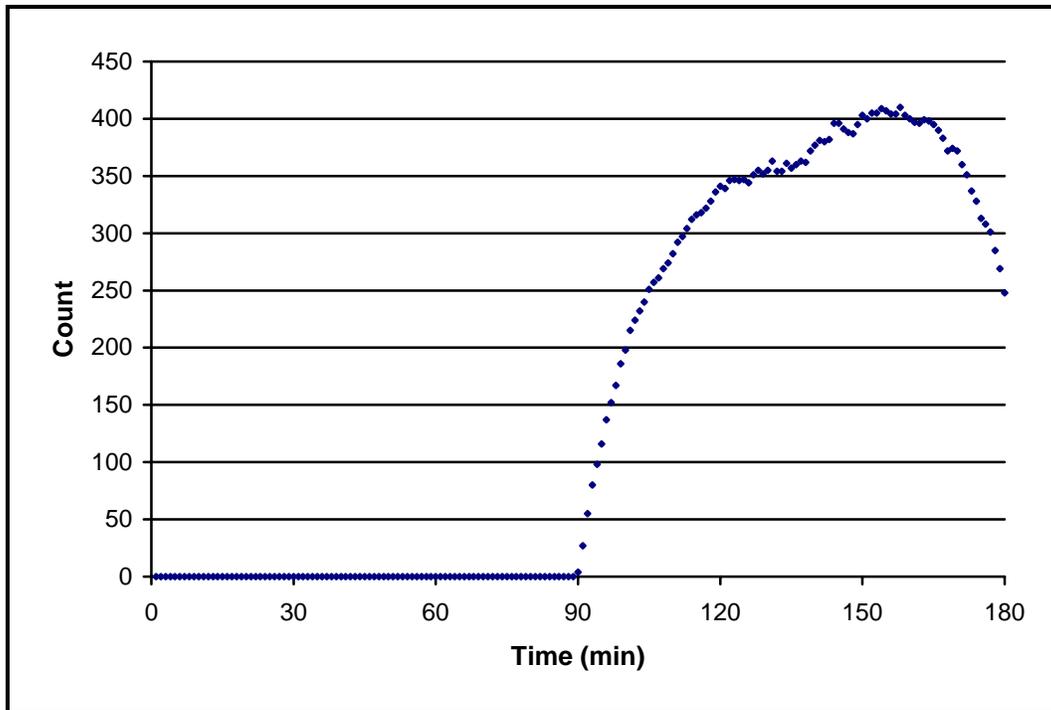


Figure 4: Count of Active Flights per Minute Increment

6.3 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference[1].

Table 11: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.320	2.209	2.334	2.440	2.310
Average Time in Center (sec)	1372.266	1299.442	1230.771	1518.800	1297.631
Average Time in Sector (sec)	582.078	583.600	518.128	615.000	553.551
Percentage by Flight Type	27.443	21.224	46.101	4.936	100.000

6.4 Ground Speed

This section corresponds to Section 3.3.4 of Reference[1]. Detailed statistics on aircraft ground speed are provided in Appendix B.

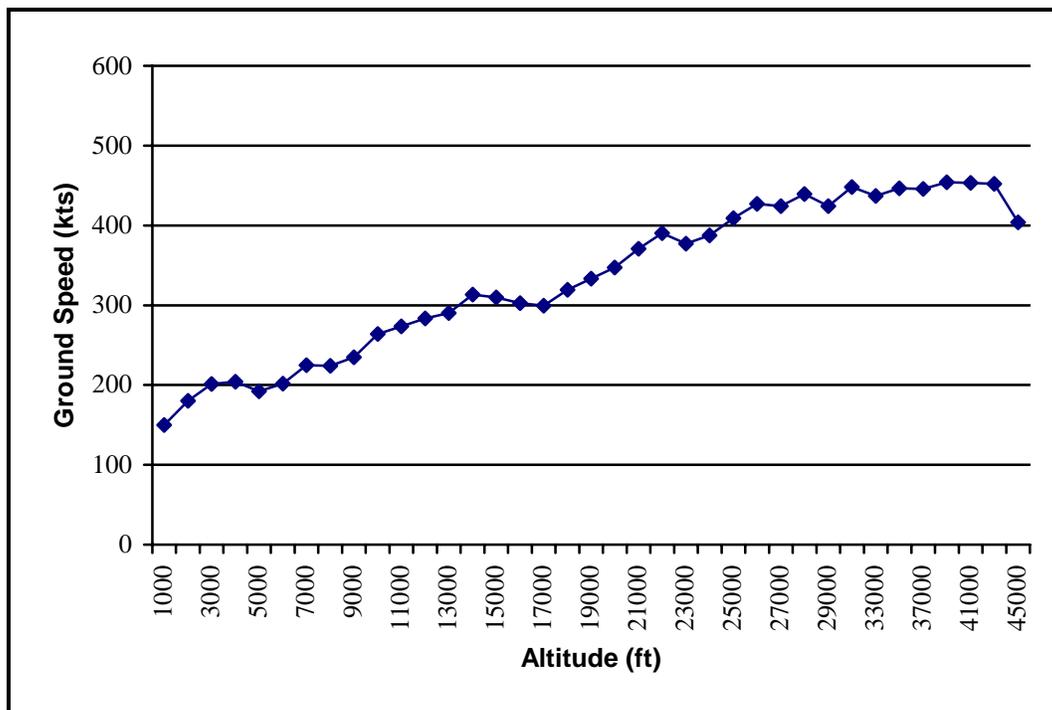


Figure 5: Average Ground Speed by Altitude for All Hours

6.5 Center to APD Ratio

This section corresponds to Section 3.3.5 of Reference[1].

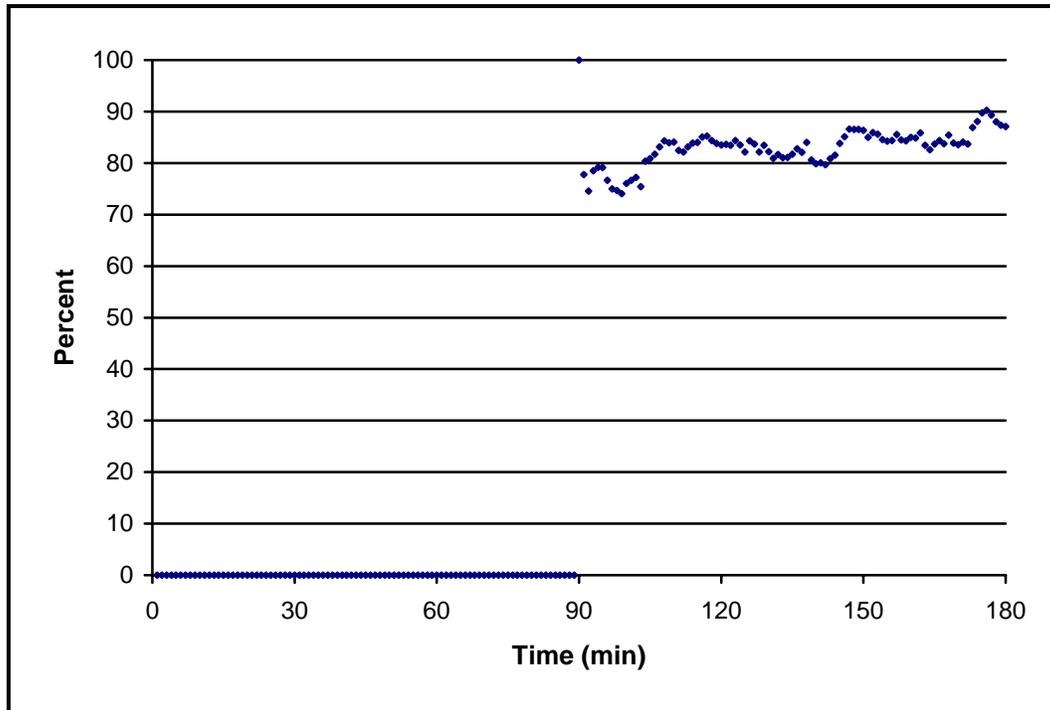


Figure 6: Percentage of Track Points in Center to APD Zone per Minute Increment

6.6 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 12: Statistics on Interim Altitude Messages⁵

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
654	2.722	1.045	7	1

6.7 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 13: Statistics on Amendment Messages per Flight⁶

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
720	2.861	1.771	13	1

⁵ Statistics on flights with interim altitude messages only

⁶ Statistics on flights with flight plan amendments only

6.8 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 14: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	6231	1940	8171
DES	8756	1704	10460
LEV	2569	1312	3881
Total	17556	4956	22512

Table 15: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	27.679	8.618	36.296
DES	38.895	7.569	46.464
LEV	11.412	5.828	17.240
Margin (%)	77.985	22.015	100.000

7 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

7.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

Table 16: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	782	76.442
P	40	3.910
T	189	18.475
Unknown	12	1.173
Total	1023	100.000

7.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1]. A full listing and count of aircraft models is provided in Appendix D.

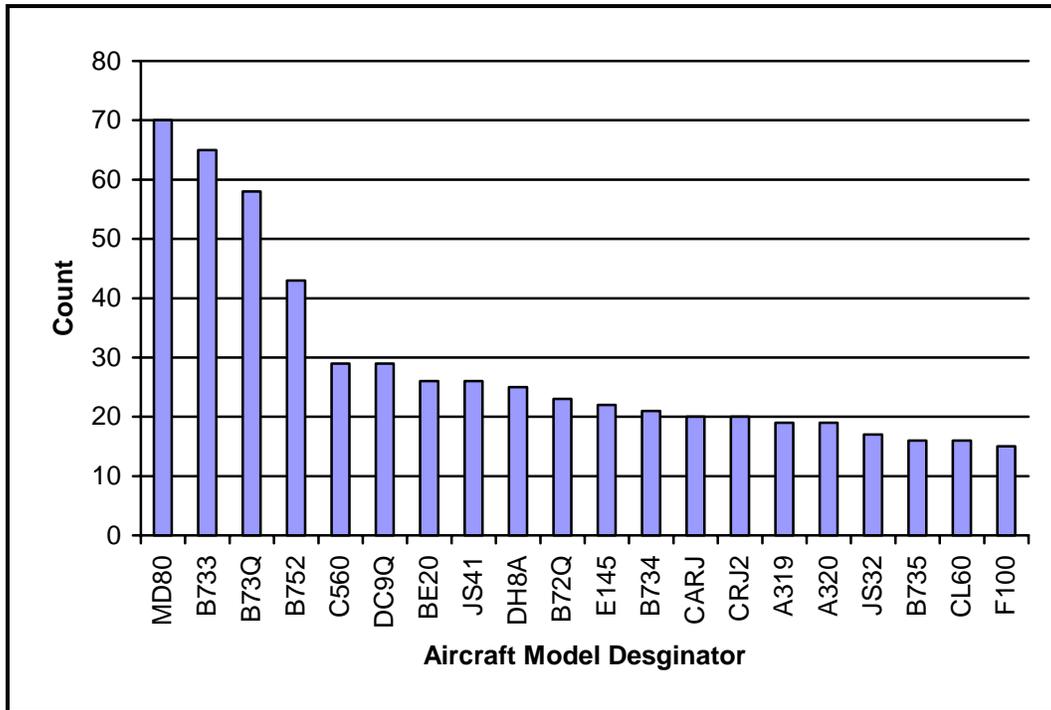


Figure 7: Count of Top Twenty Aircraft Models

7.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference[1].

Table 17: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
A	220	21.484
F	192	18.750
G	190	18.555
I	185	18.066
E	149	14.551
R	44	4.297
W	26	2.539
P	8	0.781
Q	5	0.488
Unknown	5	0.488
Total	1024	100.000

7.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

Table 18: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	723	70.605
General Aviation	235	22.949
Other ⁷	66	6.445
Total	1024	100.000

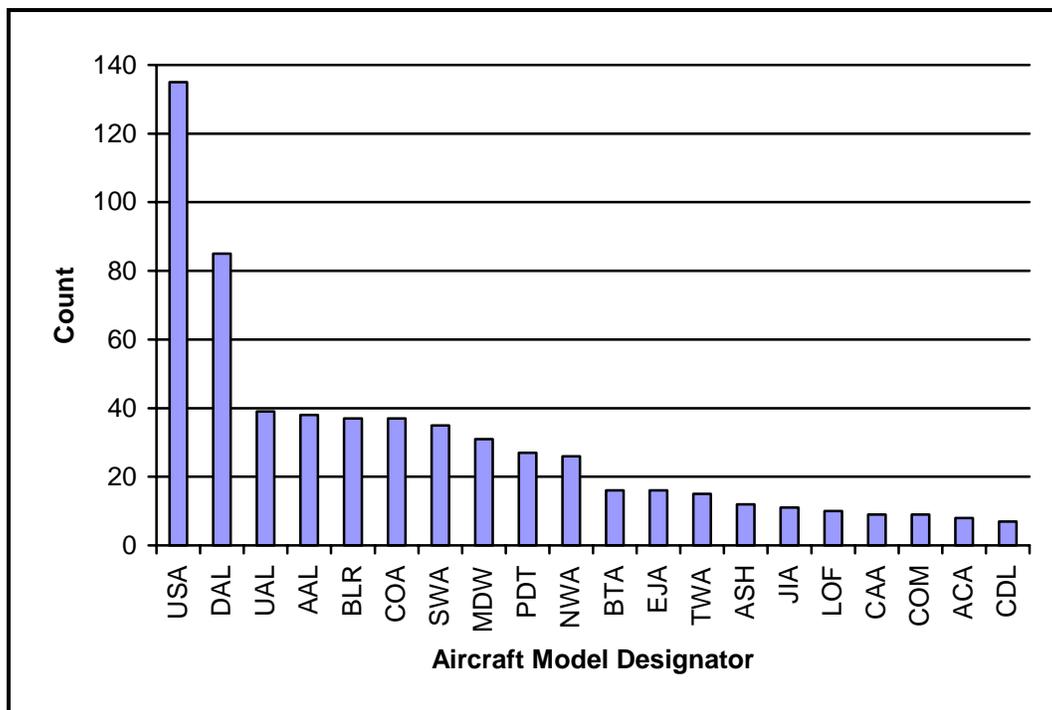


Figure 8: Count by Top Twenty Air Carriers

⁷ Includes military and aircraft with unrecognized designators

8 Flight Plan Adherence

This section provides statistics on lateral and vertical flight plan adherence and corresponds to Section 3.5 of Reference[1].

8.1 Lateral Flight Plan Adherence

This section corresponds to Section 3.5.1 of Reference[1].

Table 19: Statistics on Lateral Flight Plan Adherence by Altitude⁸

Upper Altitude (ft)	Flight Count	Max. Dist. Out (nm)	Min. Dist. Out (nm)	Average Dist. Out (nm)	Standard Dev.(nm)
10000	55	370.595	11.000	55.859	101.310
18000	25	357.877	13.061	79.342	115.813
33000	72	328.314	13.078	57.847	72.557
45000	62	264.044	14.141	44.499	37.282
Total	214				

8.2 Vertical Flight Plan Adherence

This section corresponds to Section 3.5.2 of Reference[1].

Table 20: Statistics on Vertical Flight Plan Adherence by Altitude⁹

Upper Altitude (ft)	Flight Count	Max. Dist. Out (ft)	Min. Dist. Out (ft)	Average Dist. Out (ft)	Standard Dev.(ft)
29000	550	26317	308	4540.537	2943.329
45000	163	19000	541	6050.987	3124.442
Total	713				

⁸ Statistics determined on tracks out of lateral adherence only.

⁹ Statistics were determined on tracks out of vertical adherence only.

Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

Table 21: Statistics on Aircraft Encounters by Altitude Interval for All Hours

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	0	0.000	0.000
5000	1	27.720	0.000
6000	3	16.351	13.164
7000	3	10.345	11.153
8000	9	19.860	8.986
9000	4	14.571	7.328
10000	13	15.358	6.584
11000	27	19.195	8.062
12000	50	17.760	7.990
13000	69	17.785	7.818
14000	66	17.813	8.037
15000	78	17.108	7.691
16000	86	19.121	7.716
17000	92	18.540	7.601
18000	135	18.143	7.430
19000	79	19.293	6.775
20000	114	18.489	6.882
21000	88	18.670	7.848
22000	89	17.519	7.787
23000	92	18.919	7.078
24000	123	18.739	7.401
25000	123	17.961	7.226
26000	121	18.383	7.505
27000	83	17.753	7.489
28000	128	18.610	7.444
29000	133	18.715	7.598
31000	272	17.502	8.000
33000	286	17.059	8.286
35000	204	16.864	8.227
37000	70	17.946	7.110
39000	39	18.477	6.584
41000	9	21.332	5.761
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	2689		

Appendix B: Supplement to Section 6.4 - Aircraft Ground Speed

Table 22: Statistics on Ground Speed by Altitude for All Hours

Upper Altitude (ft)	Distinct Aircraft	Average Speed (kts)	Standard Dev.(kts)
1000	10	149.978	43.694
2000	48	180.034	54.713
3000	113	201.201	47.594
4000	202	204.144	52.813
5000	289	192.283	57.925
6000	387	201.898	60.508
7000	446	224.769	49.111
8000	526	223.954	61.941
9000	560	234.849	56.648
10000	575	264.076	52.938
11000	623	273.358	66.250
12000	636	283.273	65.618
13000	633	290.230	68.101
14000	638	313.353	67.599
15000	635	309.678	69.368
16000	629	302.624	71.364
17000	604	299.522	76.399
18000	592	319.283	75.833
19000	584	333.140	77.652
20000	564	347.067	67.742
21000	548	370.887	64.620
22000	538	390.144	62.234
23000	525	377.306	68.252
24000	512	387.660	65.950
25000	491	408.955	56.696
26000	473	427.147	56.190
27000	466	424.151	53.264
28000	450	439.511	39.827
29000	415	424.208	47.360
31000	394	448.002	34.707
33000	326	436.941	26.850
35000	235	446.375	28.778
37000	129	445.527	27.153
39000	60	454.053	31.940
41000	34	453.396	26.233
43000	7	452.163	19.094
45000	2	403.750	22.038

Appendix C: Supplement to Section 6.8 - Air Traffic Maneuvers

Table 23: Count of Maneuvers by Altitude, Vertical and Horizontal Phase of Flight

Upper Altitude (ft)	Vertical Phase	Horizontal Phase of Flight	
		STR	TURN
1000	ASC	3	6
	DES	2	3
	LEV	4	8
2000	ASC	8	18
	DES	3	3
	LEV	26	35
3000	ASC	27	30
	DES	29	18
	LEV	60	51
4000	ASC	40	36
	DES	66	49
	LEV	109	62
5000	ASC	57	46
	DES	87	91
	LEV	136	73
6000	ASC	82	77
	DES	111	106
	LEV	201	97
7000	ASC	78	50
	DES	134	115
	LEV	248	95
8000	ASC	80	51
	DES	169	126
	LEV	288	108
9000	ASC	70	44
	DES	191	122
	LEV	319	109
10000	ASC	78	36
	DES	220	125
	LEV	339	96
11000	ASC	137	54
	DES	248	118
	LEV	367	115
12000	ASC	112	48
	DES	259	114
	LEV	387	92

13000	ASC	51	22
	DES	269	83
	LEV	399	76
14000	ASC	55	25
	DES	292	92
	LEV	388	68
15000	ASC	88	30
	DES	288	86
	LEV	386	65
16000	ASC	67	28
	DES	293	65
	LEV	378	52
17000	ASC	56	27
	DES	279	62
	LEV	363	35
18000	ASC	46	16
	DES	266	60
	LEV	361	33
19000	ASC	52	23
	DES	267	65
	LEV	355	37
20000	ASC	53	16
	DES	260	51
	LEV	354	33
21000	ASC	79	24
	DES	257	37
	LEV	339	25
22000	ASC	77	31
	DES	247	43
	LEV	328	30
23000	ASC	75	31
	DES	236	38
	LEV	310	35
24000	ASC	97	30
	DES	235	34
	LEV	305	45
25000	ASC	89	30
	DES	222	36
	LEV	291	32
26000	ASC	55	18
	DES	221	29

	LEV	284	20
27000	ASC	84	28
	DES	212	30
	LEV	276	15
28000	ASC	91	34
	DES	193	25
	LEV	266	23
29000	ASC	110	46
	DES	177	28
	LEV	250	19
31000	ASC	142	71
	DES	175	35
	LEV	221	34
33000	ASC	149	101
	DES	123	16
	LEV	190	28
35000	ASC	137	97
	DES	106	19
	LEV	104	22
37000	ASC	69	40
	DES	45	8
	LEV	75	25
39000	ASC	39	23
	DES	36	3
	LEV	28	7
41000	ASC	28	19
	DES	9	4
	LEV	20	4
43000	ASC	6	6
	DES	3	1
	LEV	1	0
45000	ASC	2	0
	DES	1	0
	LEV	0	0

Appendix D: Supplement to Section 7.2 - Aircraft Models

Table 24: Count and Percentage of Aircraft by Model Type

Model Type	Aircraft Count	Percent of Total
MD80	70	6.836
B733	65	6.348
B73Q	58	5.664
B752	43	4.199
C560	29	2.832
DC9Q	29	2.832
BE20	26	2.539
JS41	26	2.539
DH8A	25	2.441
B72Q	23	2.246
E145	22	2.148
B734	21	2.051
CARJ	20	1.953
CRJ2	20	1.953
A319	19	1.855
A320	19	1.855
JS32	17	1.660
B735	16	1.563
CL60	16	1.563
F100	15	1.465
C650	14	1.367
LJ35	14	1.367
B737	13	1.270
B763	13	1.270
CRJ1	13	1.270
SF34	13	1.270
B190	11	1.074
D328	11	1.074
H25B	11	1.074
C550	10	0.977
B722	9	0.879
B738	9	0.879
B762	9	0.879
BE9L	9	0.879
DC9	9	0.879
GLF4	9	0.879
B772	8	0.781

BE58	8	0.781
F15	7	0.684
LJ31	7	0.684
LJ60	7	0.684
E135	6	0.586
BE40	5	0.488
C210	5	0.488
C421	5	0.488
DH8B	5	0.488
E120	5	0.488
FA20	5	0.488
GLF2	5	0.488
LJ25	5	0.488
WW24	5	0.488
B350	4	0.391
B744	4	0.391
C130	4	0.391
C750	4	0.391
F16	4	0.391
F2TH	4	0.391
GLF3	4	0.391
H25C	4	0.391
J328	4	0.391
LJ24	4	0.391
A330	3	0.293
ASTR	3	0.293
AT43	3	0.293
B732	3	0.293
BE10	3	0.293
BE30	3	0.293
BE36	3	0.293
C5	3	0.293
E2	3	0.293
F18	3	0.293
F900	3	0.293
FA50	3	0.293
LJ55	3	0.293
MD11	3	0.293
S3	3	0.293
n/a	3	0.293
A306	2	0.195
AC90	2	0.195

B721	2	0.195
B727	2	0.195
BE33	2	0.195
C141	2	0.195
C172	2	0.195
C182	2	0.195
C2	2	0.195
C441	2	0.195
C500	2	0.195
C525	2	0.195
CL64	2	0.195
DC10	2	0.195
DH8C	2	0.195
F28	2	0.195
JS31	2	0.195
LJ36	2	0.195
LJ45	2	0.195
LR31	2	0.195
PA32	2	0.195
PAY1	2	0.195
PAY2	2	0.195
PAY3	2	0.195
SBR1	2	0.195
A340	1	0.098
AT72	1	0.098
B712	1	0.098
B72G	1	0.098
B741	1	0.098
B742	1	0.098
B757	1	0.098
BD9L	1	0.098
BE90	1	0.098
BE9F	1	0.098
BE9T	1	0.098
C135	1	0.098
C206	1	0.098
C340	1	0.098
C402	1	0.098
C501	1	0.098
DA50	1	0.098
E2C	1	0.098
E3TF	1	0.098

EA6	1	0.098
FA90	1	0.098
G3	1	0.098
GLF5	1	0.098
H25A	1	0.098
HS25	1	0.098
K35R	1	0.098
LR25	1	0.098
LR35	1	0.098
M20P	1	0.098
MD90	1	0.098
MU30	1	0.098
P180	1	0.098
P28R	1	0.098
P3	1	0.098
P32R	1	0.098
PA27	1	0.098
PA28	1	0.098
PA31	1	0.098
PA34	1	0.098
PA46	1	0.098
S3B	1	0.098
T70	1	0.098
Total	1024	100.000